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| 10/058,707 | 01/28/2002 | Atsushi Ueda | 10059-404US (P27007-01) | 7373 |
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| AKIN GUMP STRAUSS HAUER & FELD L.L.P. ONE COMMERCE SQUARE 2005 MARKET STREET, SUITE 2200 PHILADELPHIA, PA 19103-7013 | | | ALEJANDRO, RAYMOND | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 1745 | |

DATE MAILED: 02/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/058,707

Applicant(s)

UEDA ET AL.

Examiner

Raymond Alejandro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Response to Amendment

This communication is responsive to the amendment filed on 12/29/03. The applicants have overcome the 35 USC 102 rejections. Refer to the abovementioned amendment for specific details on applicant's rebuttal arguments. However, the claims (including newly added claim 16) are newly rejected over art as seen below. Thus, the present application is finally rejected for the reasons of record.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 5, 12, 14 and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Sekino et al 2002/0064712.

The present application is directed to a non-aqueous electrolyte secondary battery wherein the claimed inventive concept comprises the specific non-aqueous solvent used therein.

With respect to claims 1, 5 and 16:

Sekino et al disclose a non-aqueous electrolyte secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolyte comprising a non-aqueous solvent containing ethylene carbonate (EC), γ -butyrolactone (BL), and solutes dissolved therein and a

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third solvent consisting of at least one solvent such as vinylethylene carbonate (SECTIONS 0027-0031, 0043, 0095/CLAIMS 4, 7, 10, 15). *EXAMPLES 7, 14, 21, 25 and COMPARATIVE EXAMPLE 9* show a mixture of solvent including ethylene carbonate (EC), γ -butyrolactone (BL), and vinylethylene carbonate (VEC) (TABLES 1-4).

4. A nonaqueous electrolyte secondary battery, comprising:

- a case having a wall thickness not larger than 0.3 mm;
- a positive electrode provided in said case;
- a negative electrode provided in said case; and
- a nonaqueous electrolyte which is provided in said case and comprises a nonaqueous solvent and a solute dissolved in said nonaqueous solvent, said nonaqueous solvent containing ethylene carbonate (EC), γ -butyrolactone (BL), and at least one third solvent selected from the group consisting of ethylene sulfite, phenylethylene carbonate, 2-methylfuran, furan, thiophene, catechol carbonate and vinylethylene carbonate, the EC content falling within a range of 20 to 50% by volume based on the total amount of the EC and the BL, and the BL content falling within a range of 40 to 80% by volume based on the total amount of the EC and the BL.

[0043] The nonaqueous solvent used in the present invention comprises (a) a mixed solvent comprising 20 to 50% by volume of ethylene carbonate and 40 to 80% by volume of γ -butyrolactone, and (b) a third solvent consisting of at least one solvent selected from the group consisting of ethylene sulfite, phenylethylene carbonate, 2-methylfuran, furan, thiophene, catechol carbonate, and vinylethylene carbonate.

Example 7 mixed solvent of EC and BL (volume ratio 33:67) 99.5 wt %, 0.5 wt % VEC.

As to claims 2-3:

Sekino et al disclose the specific use of γ -butyrolactone (BL) (SECTIONS: 0027-0031, 0043, 0095/CLAIMS 4, 7, 10, 15/ Examples 7, 14, 21, 25 and Comparative Example 9).

Regarding claim 12:

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Sekino et al disclose the use of lithium containing transition metal oxide such as lithium containing cobalt oxide or lithium containing nickel cobalt oxide (SECTION 0067) and graphitized material such as graphite for the negative electrode (SECTION 0077).

As for claims 14 and 16:

Sekino et al teach the particular use of LiPF_6 and LiBF_4 as a single or a plurality of solutes (SECTION 0110).

Thus, Sekino et al anticipate the present claims.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-9 and 12-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of Mita et al 6315918.

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As to claims 1, 5 and 16:

Takami et al disclose a non-aqueous electrolyte secondary comprising an electrode group including a positive electrode, a negative electrode and a non-aqueous electrolyte including solvents and lithium salts dissolved therein (ABSTRACT). It is disclosed to use cyclic carbonates together with γ -butyrolactone (BL) wherein the cyclic carbonates include ethylene carbonate (EC), propylene carbonate (PC) and vinylene carbonate (VC) (SECTION 0058-0059). It is further disclosed that it is also desirable to prepare a mixed solvent by mixing BL with a third solvent such as PC, VC and an aromatic compound (SECTION 0059). Takami et al further disclose preferred combinations of the non-aqueous solvents including a combination of BL, EC, VC and methylethyl carbonate (MEC), a combination of BL, EC and VC, a combination of BL, PC and VC and a combination of BL, EC, PC and VC (SECTION 0061, 0174-0176).

Takami et al further discloses the specific solvents containing γ -butyrolactone in a mixed solvent containing solvents such as (SECTION 0057-0059):

[0058] It is desirable to use a cyclic carbonate together with BL in the present invention because the cyclic carbonate permits improving the charge-discharge efficiency.

[0059] The cyclic carbonate used in the present invention includes, for example, propylene carbonate (PC), ethylene carbonate (EC), vinylene carbonate (VC), and trifluoropropylene carbonate (TFPC). Particularly, if EC is used together with BL, the charge-discharge characteristics and the large discharge characteristics can be markedly improved. It is also desirable to prepare a mixed solvent by mixing BL with at least one kind of a third solvent selected from the group consisting of PC, VC, TFPC, diethyl carbonate (DEC), methyl ethyl carbonate (MEC) and an aromatic compound. The mixed solvent of the particular construction permits improving the charge-discharge cycle characteristics.

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Examples 15-18 show the following solvent combination (SECTION 0272-0275):

EXAMPLE 15

[0272] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 24% by volume of ethylene carbonate (EC), 75% by volume of γ -butyrolactone (BL) and 1% by volume of vinylene carbonate (VC).

EXAMPLE 16

[0273] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 23% by volume of ethylene carbonate (EC), 75% by volume of γ -butyrolactone (BL) and 2% by volume of vinylene carbonate (VC).

EXAMPLE 17

[0274] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 24.5% by volume of ethylene carbonate (EC), 75% by volume of γ -butyrolactone (BL) and 0.5% by volume of vinylene carbonate (VC).

EXAMPLE 18

[0275] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 25% by volume of ethylene carbonate (EC), 74% by volume of γ -butyrolactone (BL) and 1% by volume of toluene.

As for claims 2-3:

Takami et al disclose the specific use of γ -butyrolactone (BL) (SECTION 0057-0059).

Regarding claims 4 and 6-9:

As seen above, Takami et al disclose the use of mixed solvents such as vinylene carbonate (VC), propylene carbonate (PC), ethylene carbonate (EC), γ -butyrolactone (BL) and methyl ethyl carbonate (MEC) and diethyl carbonate (DEC) (Sections 0059, 0061, 0174-0176).

[0061] Preferred combinations of the nonaqueous solvents used in the present invention include, for example, a combination of BL and EC, a combination of BL and PC, a combination of BL, EC and DEC, a combination of BL, EC and MEC, a combination of BL, EC, MEC and VC, a combination of BL, EC and VC, a combination of BL, PC and VC, and a combination of BL, EC, PC and VC. In this case, it is desirable to set the mixing ratio of EC to fall within a range of between 5 and 40% by volume. It should be noted

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As to claims 12-13:

Takami et al disclose that as positive and negative electrode material the following compounds can be used (SECTION 0029):

[0029] Examples of the positive electrode active material are various oxides such as manganese dioxide, lithium manganese composite oxide, lithium-containing nickel oxide, lithium-containing cobalt oxide, lithium-containing nickel cobalt oxide, lithium-containing iron oxide, and lithium-containing vanadium oxide, and chalcogen compounds such as titanium disulfide and molybdenum disulfide. Of these materials, lithium-containing cobalt oxide (e.g., LiCoO_2), lithium-containing nickel cobalt oxide (e.g., $\text{LiNi}_{0.8}\text{Co}_{0.2}\text{O}_2$), and lithium manganese composite oxide (e.g., LiMn_2O_4 and LiMnO_2) are preferably used because high voltage can be obtained.

As negative electrode material graphite can be used (SECTION 0038).

As to claims 14 and 16:

Takami et al teaches the employment of lithium salts being LiPF_6 and LiBF_4 the most preferred (SECTION 0064):

[0064] Examples of the electrolytic salt contained in the nonaqueous electrolyte are lithium salts such as lithium perchlorate (LiClO_4), lithium hexafluoride (LiPF_6), lithium borofluoride (LiBF_4), lithium arsenic hexafluoride (LiAsF_6), lithium trifluoromethanesulfonate (LiCF_3SO_3), and bistrifluoromethylsulfonylimide lithium [$\text{LiN}(\text{CF}_3\text{SO}_2)_2$]. Of these lithium salts, LiPF_6 and LiBF_4 are most preferred.

As to claim 15:

Takami et al further disclose the following with respect to the solvent comprising a benzene-like or derivative compound such as benzene, toluene, xylene, biphenyl and terphenyl (SECTION 0063):

[0063] It is possible to use a nonaqueous solvent containing BL in an amount larger than 50% by volume and not larger than 95% by volume, EC and an aromatic compound in place of the mixed nonaqueous solvent of the composition described previously. The aromatic compound is at least one compound selected from the group consisting of benzene, toluene, xylene, biphenyl and terphenyl. EC is deposited on

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Example 41 shows the specific solvent mixing solution:

EXAMPLE 41

[0312] A thin nonaqueous electrolyte secondary battery was obtained as in Example 26, except that a nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 25% by volume of ethylene carbonate (EC), 74% by volume of γ -butyrolactone, and 1% by volume of toluene.

Takami et al disclose a non-aqueous electrolyte secondary battery according to the foregoing. However, Takami et al do not disclose the specific use of vinylethylene carbonate solvent.

Mita et al disclose non-aqueous electrolytic solutions employed in the electrochemical field (ABSTRACT). For example, Mita et al disclose that organic solvent-based electrolytic solutions (non-aqueous electrolytic solution) show high potential window of electrochemical stability (COL 1, lines 52-57/COL 3, lines 19-30). Mita et al briefly discuss secondary batteries (COL 1, lines 16-40). Mita et al also teach the cyclic carbonic esters can be used suitably for a solvent for the electrolytic solutions for use in batteries (COL 9, lines 35-47). These solvents may be used singly or in combination with one or more of them (COL 10, lines 3-5). These solvents include ethylene carbonate, ethylene carbonate, butylenes carbonate and vinylene carbonate; cyclic esters such as γ -butyrolactone, 3-methyl- γ -butyrolactone and 2-methyl- γ -butyrolactone (COL 9, lines 47-60). In particular, Mita et al exemplified the use of vinylethylene carbonate in a mixed solvent (EXAMPLES 7 and 9).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the vinylethylene carbonate solvent of Mita et al in the secondary battery of Takami et al because Mita et al teach that cyclic carbonic esters can be used suitably for a solvent for the electrolytic solutions for use in batteries as such solvents show excellent acid

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resistance, are not oxidized when allowed to stand in the atmosphere, and are chemically stable without reacting with water under normal storage conditions or reacting with highly reactive substances such as metal lithium. In addition, such cyclic carbonic ester have the properties of being physically safe, being not readily thermally decomposed and being flame-retardant and resistant to electrochemical oxidation or reduction. *Furthermore, it is noted that Mita et al and Takami et al share the same field of endeavor of providing suitable non-aqueous electrolytic solutions for electrochemical applications or resistance to electrochemical oxidation/reduction. Thus, both references are relevant to each other. Moreover, since Takami et al directly teach the use of cyclic carbonic acid esters having at least one carbon-carbon unsaturated bond in a combination of mixed solvents, a cyclic carbonic acid esters can be interchangeably used to substitute another cyclic carbonic acid esters because they are deemed to be functionally and chemically equivalent.*

6. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of Mita et al 6315918 as applied to claim 1 above, and further in view of the European document EP 0796510.

Takami et al are applied, argued and incorporated herein for the reasons above. However, Takami et al do not disclose the solvent comprising a glime.

The EP'510 document discloses a non-aqueous electrolyte system consisting of a solvent mixture containing ethylene carbonate, g-valerolactone and optionally containing one or more additional solvents selected from other organic carbonates as glymes (SECTION 0010-0011/ CLAIM 1).

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In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the solvent comprising a glyme of the EP'510 document in the solvent mixture of both Takami et al and Mita et al as the EP'510 document teaches that a mixture of solvents comprising glyme can be used in electrolyte systems for batteries as they can be applied in a broad voltage range, which has a conductivity higher than conventional conductivities at room temperature, and which shows a high stability against reduction.

7. Claim 15 is rejected again under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of Mita et al 6315918 as applied to claim 1 above, and further in view of Hamamoto et al US 2002/0001756.

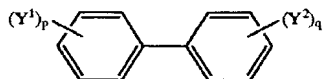
Miyazaki et al are applied, argued and incorporated herein for the reasons above. However, Miyazaki et al do not disclose the solvent comprising a derivative of benzene.

Hamamoto et al disclose the following (ABSTRACT):

(57)

ABSTRACT

A non-aqueous electrolytic solution favorably employable for a lithium secondary battery employs a non-aqueous electrolytic solution which comprises a non-aqueous solvent and an electrolyte which further contains 0.001 to 0.8 weight % of a biphenyl derivative having the formula:



In particular, Hamamoto et al teach the use of biphenyl derivatives and a cyclic compound group (SECTIONS 0016).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the solvent comprising a derivative of benzene of Hamamoto et al in

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the solvent mixture of both Takami et al and Mita et al 6315918 as Hamomoto et al teach that by using the benzene derivative as a solvent, a non-aqueous electrolytic solution which is favorably employable for a lithium secondary battery and which shows high battery performance such as high electric capacity and high cycling performance under maximum operation voltage condition or elevated temperature is obtained.

Response to Arguments

8. Applicant's arguments, see the amendment of December 29, 2003 for specific details, with respect to the rejection(s) of claim(s) 1-16 have been fully considered and are persuasive. Therefore, the rejection has been overcome. However, upon further consideration, a new ground(s) of rejection is made as seen above. Accordingly, applicant's arguments with respect to claims 1-16 have been considered but are moot in view of the new ground(s) of rejection.

9. Although not necessary due to the new grounds of rejection, the examiner wishes to briefly address applicants' arguments with respect to unexpected results due to the amount of generated gas. In this regard, it is noted that the results presented in Table 13 correspond to the battery embodiments of EXAMPLES 1-6. Accordingly, EXAMPLES 1-6 employ specific non-aqueous electrolytic solutions in restricted battery embodiments including, for instance: i) specific organic solvent compounds; ii) specific solvent compositions and molar amounts; iii) specific battery components, active materials and their constituents such as: negative and positive electrodes comprising respective active materials, binders, conductive agents, current collectors, etc, and battery separators, gaskets and the like; iv) specific battery structural arrangements; v) specific battery dimensions and the likes. Therefore, the battery embodiments

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(from which the argued unexpected results derived) are strictly related to very specific battery exemplifications that are not commensurate to the claimed invention.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Raymond Alejandro
Examiner
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A handwritten signature in black ink, appearing to read 'RAM', with a horizontal line drawn underneath it.